VALUE IN HEALTH REGIONAL ISSUES 1 (2012) 184–189

Available online at www.sciencedirect.com
SciVerse ScienceDirect
journal homepage: www.elsevier.com/locate/vhri

Economic Burden of Incident Unplanned Starts on Peritoneal Dialysis in a High Specialty Health Care Facility in Mexico City

Sergio O. Hdez Ordonez, MD[1,*], *Surrey M. Walton, PhD*[2], *Alfonso Ramos, MD*[3], *Lilia Valle, RN*[3], *Angela Sofia Rivera, MD*[4], *Frank Xiaoqing Liu, PhD*[5]

[1]*Nephrology Department, Instituto Nacional de Cardiologia "Ignacio Chavez," Mexico City, Mexico;* [2]*Department of Pharmacy Administration, University of Illinois at Chicago, Chicago, IL, USA;* [3]*Baxter Mexico, Chapultepec Morales, Mexico DF, Mexico;* [4]*Baxter Latin America, Baxter Colombia, Bogotá, Colombia;* [5]*Global Health Economics and Outcomes Research, Baxter Healthcare Corporation, Deerfield, IL, USA*

ABSTRACT

Objectives: Few studies have examined hospitalization costs for unplanned initiation of peritoneal dialysis (PD). We used data from a health care facility in Mexico to examine first hospitalization costs associated with the unplanned initiation of PD. **Methods:** Descriptive analyses focusing on initial hospitalization costs during the unplanned initiation of PD were conducted. In addition, multivariate regression models examined the association of costs with requiring urgent hemodialysis (HD) at the time of starting PD, and the association of driving distance with requiring urgent HD. **Results:** Of 195 patients hospitalized in 2010 for PD catheter placement, 51 patients met criteria for unplanned PD initiation and 25 of them required urgent HD prior to PD initiation. Ninety-two percent of the patients received 90% or greater government subsidy of hospital costs. Average inpatient costs for the first hospitalization related to the unplanned initiation of PD were 64,174 Mexican Pesos (MXN) (US $4,657). Costs were 78,683 MXN ($5,710) per patient for those requiring urgent HD and 50,225 MXN ($3,645) for those who did not, a difference ($P < 0.05$) of roughly 28,000 MXN ($2,032), and regression results were similar. In addition, long driving distance to the institution was significantly associated with requiring urgent HD. **Conclusions:** Our findings highlight potential cost savings to payers for developing better strategies to manage PD starts in Mexico and should help inform policy regarding oversight and coverage of low-income patients at risk of dialysis.

Keywords: costs, hospitalization, peritoneal dialysis, unplanned.

Introduction

Chronic kidney disease (CKD) ranks as the 12th leading cause of death worldwide and the 11th in Mexico [1,2]. CKD has five defined stages of irreversible renal function impairment that may ultimately progress to end-stage renal disease (ESRD) requiring renal replacement therapy (RRT) (i.e., peritoneal dialysis [PD], hemodialysis [HD], and/or kidney transplantation) for survival [1–4]. Most countries, including Mexico, have yet to develop and implement prevention, early detection, and intervention policies for CKD and ESRD, which may result in an underestimate of the current burden of the disease [4]. According to the Kidney Early Evaluation Program, CKD is highly prevalent, with a 22% prevalence rate in Mexico City, but mostly underdiagnosed and underrecognized even among high-risk individuals [5]. Different authors talk about the growing incidence and prevalence of not only CKD but also ESRD in Mexico, estimating in 2008 at least 4.5 million with CKD at any level and 130,000 with ESRD and RRT requirement [6–8]. Furthermore, in addition to diabetes, hypertension, and obesity, CKD in Mexico and other countries has been associated with poverty and low socioeconomic status [7,9,10].

Currently, some South American countries have reached universal access to RRT, while others, including Mexico, have covered almost two-thirds of the population with social security [2,11]. In 2009, López-Cervantes et al. [6] used modeled data and concluded that there were roughly 129,000 Mexicans with urgent need for RRT, with only half receiving it by means of social security, leaving the poor and unemployed without access to RRT [6].

As the use of PD accounts for 60% to 80% of the total population with RRT in Mexico, understanding PD costs is particularly important [6,9,12–15]. Past studies within Mexico have found that the annual total health care costs per patient of PD were lower than those for in-center hemodialysis and that PD was cost-effective in treating patients with ESRD, which may explain why the ratio of in-center hemodialysis to PD is 24:76 [16–20]. For example, a recent study in Mexico reported that in 2006 the total treatment-related costs of PD were $15,724 per patient compared with $24,032 per patient for in-center hemodialysis [16]. In measuring the costs of PD treatment, hospitalization has been shown to represent a substantial portion of costs, and this is true in Mexico [21]. In addition, per patient costs for PD are likely to increase when there

Conflicts of interest: The authors have indicated that they have no conflicts of interest with regard to the content of this article.

* *Address correspondence to:* Sergio O. Hdez Ordonez, Nephrology Department, National Institute of Cardiology "Ignacio Chavez," Juan Badiano # 1, 4th Floor, Tlalpan. D.F., México City 14080, Mexico.

E-mail: oscar.hernandez@cardiologia.org.mx.

2212-1099 – see front matter Copyright © 2012, International Society for Pharmacoeconomics and Outcomes Research (ISPOR). Published by Elsevier Inc.

http://dx.doi.org/10.1016/j.vhri.2012.10.007

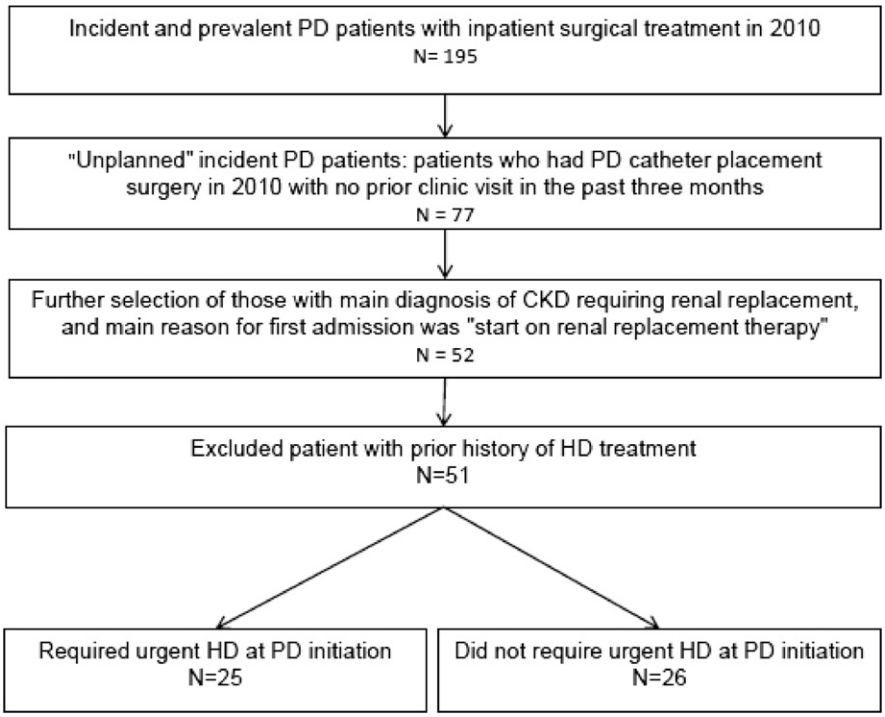

Fig. 1 – Sample selection and sample sizes for unplanned initiation of peritoneal dialysis (PD). CKD, chronic kidney disease; HD, hemodialysis.

are gaps or delays in care that result in unplanned dialysis initiation, and hospitalizations may be different for the unplanned initiation of PD in an uninsured population [22]. Furthermore, one of the reasons hospitalization costs are so important is that RRT therapy is only available inpatient for the uninsured because they cannot afford home care, but the government subsidizes inpatient treatment [6,7,23–25]. Hence, it is useful to focus on understanding hospitalization costs related to the unplanned initiation of PD in an uninsured population to inform policy regarding PD treatment. We are unaware of any published studies regarding the hospitalization costs of the unplanned initiation of PD for Mexico, or any other Latin American country. Furthermore, patients who delay care may require urgent HD prior to being put on PD, and the cost and outcome implications of those requiring urgent HD versus those who do not have not been studied in a Latin American population.

This study presents new information about hospitalization costs associated with unplanned PD initiation in an uninsured population in 2010 from a high specialty health care facility from a payer perspective. Furthermore, the study compares costs for patients who required urgent HD at the time of initiating PD versus those who did not and examines the association of distance from the clinic on the need for urgent HD.

Methods

Data

The project utilized highly detailed retrospective data based on linked medical and financial claims records from the National Institute of Cardiology Ignacio Chavez in Mexico from January to December 2010. This hospital and clinic in Mexico serves patients who do not have social security in Mexico. Every patient receives a socioeconomic survey that takes into account the address and employment of the patient, and that information is used to determine the level of subsidy.

The data allowed selection of patients experiencing unplanned initiation of PD along with detailed information regarding inpatient costs. The patients in the data were first identified on the basis of surgical records at the hospital indicating PD catheter placement for the first time within the time frame of January 1, 2010, to December 31, 2010. Within that group, incident unplanned patients were selected on the basis of information from the hospital's ambulatory clinic. In particular, patients with any PD-related visit scheduled during the 3 months prior to the surgery were excluded. Furthermore, the clinical notes for the patients in the medical records were checked and patients with a primary reason for surgery denoted as starting PD were included. Finally, one patient was excluded for having a history of HD treatment before switching over to PD treatment. From the selected population of unplanned initiation of PD, medical records were used to further identify patients who required urgent HD during the initial hospitalization for PD catheter placement (see Fig. 1).

For each patient, detailed patient demographic and clinical records as well as inpatient costs were collected from financial claims and medical records. We also observed the level of government subsidy issued for each patient. Distance from the hospital was also estimated on the basis of knowledge of the hometown of the patient in the medical record. Costs were available at several levels of granularity down to the item code; however, it was not possible to associate dates for costs other than the admission and discharge date of the hospitalization. Note that in examining the costs of PD bags, we discovered inconsistencies between the financial records and the lists of supplies given to patients. PD bags have fewer controls than other supplies, and often the information for the PD bags that were given to poorer patients was not passed along to financial claims. Consequently, for costs associated with PD bags, which are part of the pharmacy supplies department, we subtracted the

Table 1 – Descriptive characteristics of patients with unplanned PD initiation.

	All patients	Required HD	Did not require HD
Sample size	51	25	26
Demographics			
Age (y), mean ± SD	49.35 ± 18.52	47.99 ± 18.59	50.65 ± 18.73
Males (%)	54.90	52.00	57.69
SES (%)			
Govt. subsidy ≥ 90%	92.16	100.00	84.62
Govt. subsidy = 70%	5.88	0.00	11.53
No govt. subsidy	1.96	0.00	3.85
Distance			
Traveling distance to hospital (km), mean ± SD	61.44 ± 103.63	77.94 ± 113.56	45.58 ± 92.55
Percent with distance > 39.5 km	23.53	40.00*	7.69*
Other risk factors (%)			
Diabetes	41.18	44.00	38.46
Hypertension	41.18	32.00	50.00
Cardiovascular†	21.57	16.00	26.92
Autoimmunity‡	5.88	4.00	7.69
Kidney allograft failure	7.84	4.00	11.54
MDRD§, mean ± SD	6.03 ± 4.29	4.59* ± 3.42	7.41* ± 4.64

Govt., government; HD, hemodialysis; PD, peritoneal dialysis; SES, socioeconomic status.

* Indicates differences across required HD that were statistically significant at the 5% level (t test for continuous variables and Fisher's exact test for proportions).

† Cardiovascular is any combination of congestive heart failure, coronary artery disease, or cardiovascular disease.

‡ Autoimmunity is either microscopic polyangitis or systemic lupus erythematosus.

§ MDRD stands for modification of diet in renal disease and is based on the four-variable equation and measured in terms of ml/minute/1.73 m^2. Lower values indicate worse functioning.

claims costs for PD solutions and added costs for bags listed in the medical records using a cost of 25 Mexican Pesos (MXN) ($1.81) for each bag. 25 MXN was equivalent to the charges for the same type of bags seen in the claims data. All other cost data came straight from the financial records and were consistent with the other available data. In all the analyses, the data used had been delinked and deidentified, and the project was found to be exempt by official institutional review board review.

Statistical Analyses

Detailed descriptive analyses of available patient demographics, including distance patients traveled, as well as a variety of detailed clinical characteristics were conducted for all the included patients and across patients who required urgent HD versus those who did not during the initial visit. For the same sets of patients, costs associated with the first hospitalization were examined. Furthermore, costs were grouped and described at the hospital department level (e.g., Procedures, Imaging, Lab Tests, and Hospital Beds). All costs were reported in 2010 MXN and converted to US dollars for display here on the basis of a currency exchange rate published at the central bank of Mexico Web site (http://www.banxico.org.mx/indexEn.html) on May 16, 2012, of 13.7799 MXN for each US dollar.

Standard t tests for continuous variables and Fisher's exact tests for frequency variables were conducted across those with and without urgent HD prior to PD initiation to establish statistical significance at the 5% level. In addition, we conducted multivariate modeling of costs to examine the impact of requiring urgent HD controlling for available risk measures in the data: age, gender, government subsidy status, residual renal function, and presence of comorbidities. Specifically, following recommendations in Manning and Mullahy [26], we determined that a generalized linear model with a log link would be most consistent and ran a modified park test that suggested the gamma distribution. Predicted costs with the indicator for having urgent HD set to 1 for everyone minus the predicted costs with everyone coded as 0 for urgent HD were then used to estimate the marginal impact of urgent HD on costs. Finally, logistic regression was used to examine the relationship between requiring urgent HD and living in the upper quartile of distance, again controlling for available risk measures. All analyses used STATA SE version 11 (College Station, TX).

Results

There were 195 prevalent patients for PD-related surgery and 77 incident patients. Of the 77 incident patients, 51 unplanned starts of dialysis were identified and of these 51 patients, 25 required urgent HD during their visit for the initial PD surgery (see Fig. 1).

Table 1 contains descriptive characteristics of the patient population. Although few variables were statistically significant across the groups, in the HD group the estimated glomerular filtration rate using the modification of diet in renal disease formula was lower and the proportion of patients driving further than 39.5 km was higher.

The average total cost of the first hospitalization for an unplanned start of PD was 64,174 MXN (US $4,657), with most of the costs categorized as hospital bed rates and procedures (Table 2). Costs of the first hospitalization were 78,683 MXN ($5,710) per patient for those requiring urgent HD prior to PD initiation and 50,225 MXN ($3,645) for those not requiring HD prior to PD initiation. Consistent with the descriptive results, the regression results (see Table 3) indicated a significant coefficient for urgent HD ($P < 0.01$) and the marginal predicted impact of urgent HD was 21,955 MXN ($1,593). In the regression results, the hypertension coefficient was not significant at the 5% level, but it was negative, which was unexpected. There are no direct clinical reasons that would explain why patients with hypertension would have lower costs versus those without hypertension. The population without hypertension in this study, however, did appear to be different. We found that patients without hypertension had much lower residual renal function measured with the modification of diet in renal

Table 2 – Per patient costs of first hospitalization by department (2010 MXN).

Costs of first hospitalization*	Full sample of unplanned initiation of PD (n = 51)	Required urgent HD during PD initiation (n = 25)	Did not require urgent HD (n = 26)
Department			
Blood bank and blood products	424.08 (<1%)	816.00 (1%)	46.96 (<1%)
Pharmacy supplies	3027.14 (5%)	3632.26 (5%)	2445.30 (5%)
Drugs	3,086.65 (5%)	3,233.44 (4%)	2,945.50 (6%)
Hospital bed rates	28,301.88 (44%)	34,267.68 (44%)	22,565.54 (45%)
Imaging	4,588.12 (7%)	5,840.32 (7%)	3,384.08 (7%)
Laboratory tests	7,068.71 (11%)	8,215.56 (10%)	5,965.96 (12%)
Operating room material	1,006.32 (2%)	1,637.91 (2%)	399.01 (1%)
Procedures	16,318.98 (25%)	21,039.36 (27%)	11,780.15 (23%)
Professional service fees	352.92 (<1%)	0.00 (0%)	692.27 (1%)
Total	64,174.79	78,682.81†	50,224.77†

HD, hemodialysis; PD, peritoneal dialysis.

* The costs presented are mean values. To obtain the costs in US dollars, an exchange rate of 13.7799 Mexican pesos per US dollar should be used (see text for details).

† Denotes statistically significant differences at the 5% level across groups; note here only the differences in total costs were tested across groups by using a t test for continuous variables.

disease formula at the time of hospital admission, and there was a larger percentage of them who required urgent HD.

Table 4 contains results from the logistic regression on requiring urgent HD. We found that patient age, gender, and most of the comorbidities (kidney allograft failure the exception) were not significantly related. However, an indicator for being in the upper quartile of distance from the hospital (living > 39.5 km away) had a statistically significant odds ratio of greater than 20 for requiring urgent HD.

Discussion

To our knowledge, this is the first study in Mexico to examine hospitalization costs for unplanned PD initiation [6]. The average age and rate of diabetes in our population were consistent with those found in larger registries of dialysis patients in Mexico, particularly if you look at numbers for those without social security [27]. Our population had low socioeconomic levels, with 92.16% eligible for a 90% or greater government subsidy for hospital costs. The analyses revealed substantial costs associated with the first hospitalization of unplanned starts of PD in Mexico. Furthermore, patients who required urgent HD at the time of initiating unplanned PD treatment were associated with an increase in the cost of first hospitalization of 21,955 MXN ($1,593) controlling for available patient characteristics. We also found that living more than 39.5 km (the upper quartile of distance in the sample) from the hospital was significantly related to requiring HD. To add some context, a previous study estimated that the total societal perspective treatment costs per patient for PD were $15,724 in 2006 [16]. The costs of the first

Table 3 – General linear model regression of costs for first hospitalization on urgent HD and other risk factors.

GLM Regression*	DV: Total cost of first hospitalization	P
Urgent HD	0.344	0.007
Subsidy ≥ 90%	0.156	0.503
Male	−0.027	0.862
Age	0.011	0.041
MDRD†	−0.041	0.189
Had cardiovascular	0.065	0.810
Had diabetes	0.020	0.915
Had hypertension	−0.393	0.086
Had autoimmune	0.576	0.147
Had kidney allograft failure	−0.158	0.688
Constant	10.502	<0.001
AIC = 24.43		

AIC, akaike information criterion; DV, dependent variable; GLM, generalized linear model; HD, hemodialysis.

* Regression was a gamma GLM with a log link using robust errors. Predicted costs with urgent HD set to 1 for everyone were 75,347 MXN, and were 53,392 MXN with urgent HD set to 0.

† MDRD stands for modification of diet in renal disease and is based on the four-variable equation and measured in terms of ml/minute/1.73 m^2. Lower values indicate worse functioning.

Table 4 – Logistic regression on patients requiring urgent HD during PD initiation.

Logistic regression*	DV: Required urgent HD	P
Distance in upper quartile (>39.5 km)	23.87	0.002
Male	1.296	0.701
Age	1.016	0.570
MDRD†	0.775	0.101
Had cardiovascular	0.350	0.243
Had diabetes	2.526	0.308
Had hypertension	0.782	0.764
Had autoimmune	1.161	0.925
Had kidney allograft failure	0.099	0.046
Psuedo R^2 = 0.2738		

DV, dependent variable; HD, hemodialysis; PD, peritoneal dialysis.

* Note that subsidy of 90% or more could not be used in the logistic regression because all patients with urgent HD had 90% or more subsidy. Coefficients reflect odds ratios. The results are for a logistic model with robust standard errors.

† MDRD stands for modification of diet in renal disease and is based on the four-variable equation and measured in terms of ml/minute/1.73 m^2. Lower values indicate worse functioning.

hospitalization that we found for the unplanned initiation of PD were over 25% of that number, and substantially more for those requiring urgent HD [16]. Overall, the results support that delays and/or poor awareness of the need for care for patients can raise costs for institutions.

PD is recognized as an important treatment for patients with chronic kidney conditions in Latin America and especially Mexico [9,12]. In Mexico, however, there currently is no structured policy for early detection. Adding to the concern is that RRT is unbalanced between people with and without health coverage. Access to treatment is restricted for patients without coverage, and it is reflected by dialysis rates that are almost one third less than for people with coverage. In addition, there are few facilities with the capability to offer dialysis treatment to this group, and services are limited. Meanwhile, patients have to pay at least part of the treatment costs and this precludes some patients from receiving adequate treatment. Furthermore, most hospitals are located in big cities and can be far from where patients at risk are living. The distance means more costs, which many cannot afford. Although beyond the scope of our study, there can by significant costs not only for the patients but for relatives as well [12].

The results help quantify the potential benefit of improved screening, particularly if screening can reduce the need for urgent HD at the time of PD initiation. Public screening in Mexico has yet to develop; however, a pilot for the Kidney Early Evaluation Program has been applied in Mexico City and Jalisco. This program aims to detect renal disease in high-risk populations such as those with diabetes and hypertension. According to the results from the screening, the prevalence of CKD was 22% in Mexico City and 33% in Jalisco, which was similar to the Kidney Early Evaluation Program report in the United States (prevalence 26%). An important finding was that most of the participants were unaware of the CKD diagnosis. The authors conclude that CKD is highly prevalent, underdiagnosed, and underrecognized in high-risk individuals in Mexico [5]. Another Mexican survey in an urban Mexican population showed that the percentage of the population in each stage of renal function as suggested by the Kidney Disease Outcomes Quality Initiative guidelines was similar between Mexican and US populations [10]. Given the prevalence levels, there is room for better programs to help improve patient outcomes and save resources.

With respect to the health system, about 50% of the population is covered by three social security institutions: Instituto Mexicano del Seguro Social, Instituto de Seguridad y Servicios Social para los Trabajadores del Estado, and the Army. The remaining half of the population is left to take care of itself. In the past 5 years, a new voluntary popular insurance administered by the Health Ministry saw some take up in low-income populations, where there are currently 10 million poor people in Mexico. Only patients within the social security system have universal coverage including RRT and only one institution, the Instituto Mexicano del Seguro Social, takes care of about 80% of the current patients with ESRD on treatment [9]. Hence, overall, 50% of the Mexican population receives treatment similar to those given in this institute. Because it is highly unlikely that Mexico will be able to afford the expense of maintaining a large dialysis population, as in the developed world, it is only through prevention that Mexico can adequately face this devastating disease [12]. Policymakers have not yet assigned the time and resources needed to prepare the Mexican health care system for the rapidly growing burden of ESRD [9].

Much remains to be learned regarding this patient population and these treatments. In addition to the concerns raised above, a major issue is that patients with PD are rarely able to restart their working life. Future research into treatments will help in understanding the decision between continuous ambulatory peritoneal dialysis and automated peritoneal dialysis (APD). For example, APD can free up therapy during the day so that patients can begin to work again. A promising area is to look at getting APD for younger patients to reincorporate them into working life. The institute that provided the data for this project has begun its own formal PD program. Evaluation of that program and similar ones in Latin America would provide further important information for shaping policy toward these patients.

Limitations

The results are from a retrospective data analysis of a single year in a single institution in Mexico. Hence, our sample size was limited. In addition, the findings are most likely to apply to public health institutions that provide in-hospital acute RRT to uninsured ESRD patients with low socioeconomic status, but caution should be taken in generalizing the findings to other settings. In addition, there was inherently no information on care received or the clinical characteristics across time in the patients prior to starting PD. The multivariate analyses, because of the limited retrospective data, may suffer from omitted variable bias and low statistical power.

Conclusions

The results help quantify the magnitude of costs of unplanned PD starts for low-income patients in Mexico, particularly for those patients who experience delayed care to the point where they require urgent HD. The findings assist in understanding the potential gains from improved oversight of PD. They suggest particularly high benefits for strategies that could prevent the need for urgent HD at the time PD is initiated. Also, patients in relatively remote areas may be at a higher risk of requiring urgent HD at the time of hospitalization for unplanned initiation of PD. Overall, the costs highlight the importance of promoting patient awareness of and encouraging PD initiation as soon as it is clinically warranted. This should help inform policy for developing a well-structured PD program to enhance oversight and coverage of low-income patients at risk of dialysis in Mexico.

Source of financial support: This project was supported by funding from Baxter Healthcare Corporation, Deerfield, IL. Surrey M. Walton received payment for consulting services on the project. The views expressed in the manuscript are the author's and may not reflect the official views of Baxter.

Supplemental Material

Supplemental material accompanying this article can be found in the online version as a hyperlink at http://dx.doi.org/10.1016/j.vhri.2012.10.007 or, if hard copy of the article, at: http://www.hvalueinhealthjournal.com/issues (select volume, issue, and article).

REFERENCES

[1] Codreanu I, Perico N, Sharma SK, et al. Prevention programmes of progressive renal disease in developing nations. Nephrology (Carlton) 2006;11:321–8.
[2] National Institute of Statistics, Geography and Informatics (INEGI). 2010 Census results, population, home and living, death causes. Available from: http://www.inegi.org.mx/default.aspx. [Accessed June 1, 2012].
[3] Nugent RA, Fathima SF, Feigl AB, Chyung D. The burden of chronic kidney disease on developing nations: a 21st century challenge in global health. Nephron Clin Pract 2011;118:c269–77.
[4] Levey AS, Coresh J. Chronic kidney disease. Lancet 2012;379:165–80.

[5] Obrador GT, García-García G, Villa AR, et al. Prevalence of chronic kidney disease in the kidney Early Evaluation Program (KEEP) México and comparison with KEEP US. Kidney Int Suppl 2010;116:S2–8.
[6] López-Cervantes M, Rojas-Russell ME, Tirado-Gómez LL, et al. Chronic kidney disease and its attention with renal replacement therapy in Mexico. 2009. Available from: http://www.dged.salud.gob.mx/contenidos/dged/descargas/ERC-4may.pdf. [Accessed June 11, 2012].
[7] Treviño-Becerra A, Peña-Rodríguez JC, Reyes-Marín FA, Tamayo-Orozco JA. Therapeutic advances in nephrology. Gac Med Mex 2008;144:509–23.
[8] U.S. Renal Data System. USRD 2010 Annual Data Report: Atlas of Chronic Kidney Disease and End-Stage Renal Disease in the United States. Bethesda, MD: National Institute of Diabetes and Digestive and Kidney Diseases, 2010.
[9] Paniagua R, Ramos A, Fabian R, et al. Chronic kidney disease and dialysis in Mexico. Perit Dial Int 2007;27:405–9.
[10] Amato D, Alvarez-Aguilar C, Castañeda-Limones R, et al. Prevalence of chronic kidney disease in an urban Mexican population. Kidney Int Suppl 2005;97:S11–7.
[11] Lugon JR, Strogoff de Matos JP. Disparities in end-stage renal disease care in South America. Clin Nephrol 2010;74(Suppl.1):S66–71.
[12] Garcia-Garcia G, Renoirte-Lopez K, Marquez-Magaña I. Disparities in renal care in Jalisco, Mexico. Semin Nephrol 2010;30:3–7.
[13] Pecoits-Filho R, Campos C, Cerdas-Calderon M, et al. Policies and health care financing issues for dialysis in Latin America: extracts from the roundtable discussion on the economics of dialysis and chronic kidney disease. Perit Dial Int 2009;29(Suppl. 2):S222–6.
[14] Cusumano AM, Di Gioia C, Hermida O, Lavorato C. Latin American registry of dialysis and renal transplantation. The Latin American Dialysis and Renal Transplantation Registry Annual Report 2002. Kidney Int Suppl 2005(97):S46–52.
[15] Jain AK, Blake P, Cordy P, Garg AX. Global trends in rates of peritoneal dialysis. J Am Soc Nephrol 2012;23:533–44.
[16] Prieto I, Bhattacharyya S, Divino J, et al. Costs of treating ESRD patients with various dialysis therapies in Mexico. The 6th World Congress on Health Economics; Copenhagen, Denmark; 2007.
[17] Walker D, Bhattacharyya S, Prieto I, Paniagua R. Increased utilization of peritoneal dialysis therapy could substantially reduce dialysis budget for Mexico. The 8th European Peritoneal Dialysis Meeting; Helsinki, Finland; 2007.
[18] Arredondo A, Rangel R, de Icaza E. Cost-effectiveness of interventions for end-stage renal disease. Rev Saúde Pública 1998;32:556–65.
[19] Cueto-Manzano AM, Rojas-Campos E. Status of renal replacement therapy and peritoneal dialysis in Mexico. Perit Dial Int 2007;27:142–8.
[20] Otero Cagide F, Schettino M, Rodriguez Rodriguez A, et al. Cost effectiveness analysis in patients with chronic renal insufficiency in dialysis. Nefrologia Mexicana 2002;23:147–56.
[21] Blake P, Just P. Economics of dialysis. In: Horl WH, Koch KM, Lindsay RM, eds. Replacement of Renal Function by Dialysis. (5th ed) Dordrecht, The Netherlands: Kluwer Academic; 2004.
[22] Mendelssohn DC, Malmberg C, Hamandi B. An integrated review of unplanned dialysis initiation: reframing the terminology to suboptimal initiation. BMP Nephrol 2009;10:22.
[23] Frenk J, González-Pier E, Gómez-Dantés O, et al. Comprehensive reform to improve health system performance in Mexico. Lancet 2006;368:1524–34.
[24] National Health Program 2007–2012 (SBN 978-970-721-414-9). Mexico: Health Ministry, Mexican Government, 2007:50–51. Available from: http://new.paho.org/hq/dmdocuments/2010/Politicas_Nacionales_Salud-Mexico_2007-2012.pdf. [Accessed September 1, 2012].
[25] Su-Hernández L, Abascal-Macías A, Méndez-Bueno FJ, et al. Epidemiologic and demographic aspects of peritoneal dialysis in Mexico. Perit Dial Int 1996;16:362–5.
[26] Manning WG, Mullahy J. Estimating log models: to transform or not to transform? J Health Econ 2001;20:461–94.
[27] Garcia-Garcia G, Monteon-Ramos JF, Garcia-Begarano H, et al. Renal replacement therapy among disadvantaged populations in Mexico: a report from the Jalisco Dialysis and Transplant Registry (REDTJAL) 2005;68(Suppl):S58–61.